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ABSTRACT

This illustrated booklet describes research procedures in the Infant Laboratory of the Educational Testing Service to investigate measurable factors in infant behavior which can predict intellectual potential. The research is currently focusing on attending, the manner in which infants respond to various stimuli presented to them during their earliest months. Preliminary findings indicate that the length of time of attention gives evidence of the activity levels of the infant's nervous system. Infant's response to an arresting stimulus includes: opening his eyes, expanding pupils, slowing down breathing, slowing down heart rate, decreasing motor movement, babbling in response to social stimulus, stopping babbling in response to non-social stimulus. Changes in response to stimulus develop about the age of three months. Infants suffering from brain damage do not change their responses. Infants provided with more home environmental stimulation habituate faster to test stimuli, indicating they are more intellectually alive. Experiments relating cognitive development to shortening attentional responses indicate that this factor may be a yardstick of intellectual potential. Further studies will explore cultural implications. (DJ)

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# PREDICTING THE FUTURE:

## Studies on the Growth of Intellect

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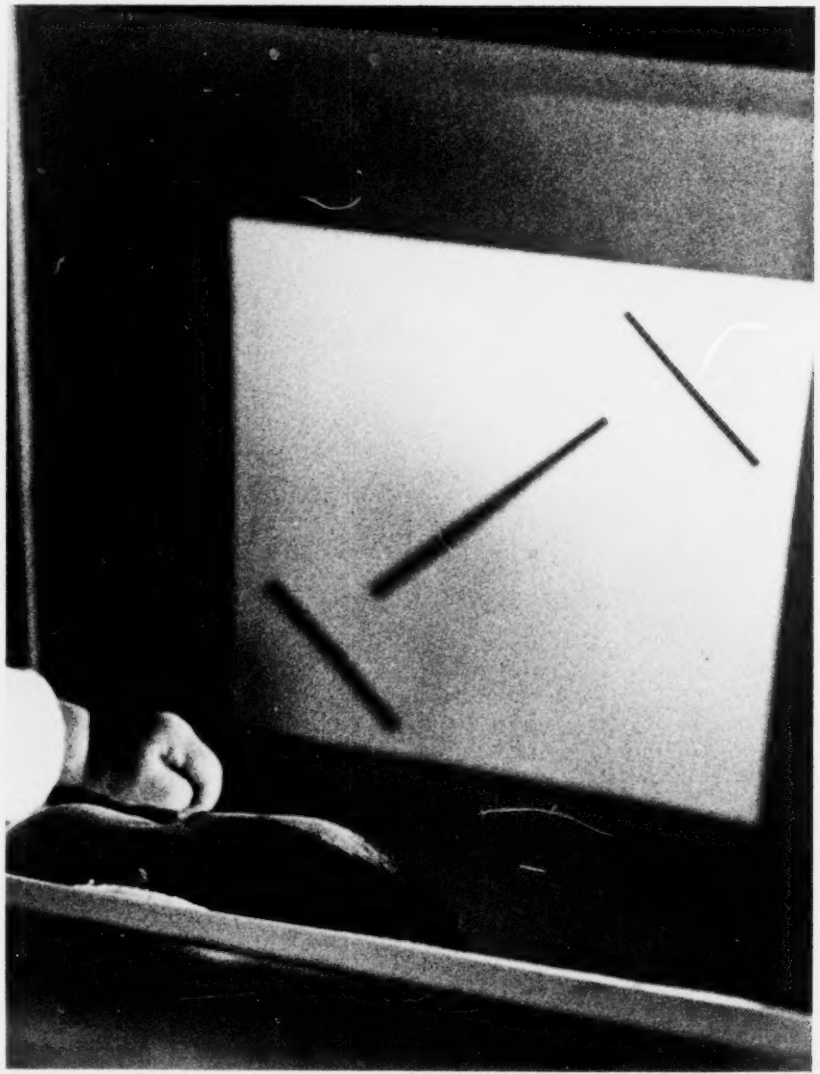

MANY parents, as they observe their babies' responses to the multitude of new sensory experiences encountered during early life, ask themselves a number of questions. Will our child be bright, average, or dull? What do his various sounds and movements mean? What can we do to help him realize his fullest potential? The fact that these questions are asked at all implies that there may be answers to them, and that the child's apparently random sounds and movements may be used to predict his future development.

Psychologists and educators who are studying infant behavior for such revelations have begun to gather evidence which suggests that predictions about future development may indeed be possible. A growing body of findings offers the hope that the infant may display certain response patterns which might, to some degree, forecast the kind of adult he will become.

These considerations are at the heart of the research being conducted at the Infant Laboratory of Educational Testing Service, Princeton, New Jersey. Under the direction of Dr. Michael Lewis, researchers are studying the phenomenon of "attending," the manner in which infants respond to various stimuli presented to them during their earliest months. Basically, the project is an exploration of the rate at which an infant "gets bored" with sensory experiences, and is an attempt to relate this to his prospects for intellectual development. The inquiry asks one central question: Is it possible to gain insights into the development of personality and intellect through a controlled study of certain aspects of infant behavior?

## BACKGROUND

The work at the Infant Laboratory is one of a number of research programs by experimental psychologists into the precursors of human intelligence. As a result of the research, some dramatic conclusions have been reached about infant potential. It is now known, for example, that a baby's senses can operate in a fairly sophisticated fashion from the day of birth. An infant can respond with surprisingly acute discrimination to sight, sound, taste, and odor.

Whether or not these responses constitute "learning" experiences for the infant is the problem under consideration by the ETS research team. Their inquiry indicates that it might be possible to tap and identify the sources of emerging intellectuality far earlier in life than was previously thought possible.

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## THE NATURE OF ATTENDING

Preliminary findings of the Infant Laboratory researchers indicate that infants, even a few hours after birth, will focus their sight on stimuli which appear in front of them. The stimulus could be a toy, a blinking light, or a mother's face. They will respond with varying degrees of interest to that stimulus, and their attention may last for as little as a few seconds or as much as a few minutes.

An altered heart rate and breathing rhythm, physical gestures in the direction of the stimulus, facial expressions, and excited babblings may characterize the infant's response. It is the duration of this response and



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the length of time during which the young subject is "attending" to the stimulus that the Infant Laboratory is measuring. Attending, for the purposes of this study, gives evidence of the activity levels of the infant's nervous system. It would seem that the more quickly the infant withdraws his attention from the sensory stimulus, the more quickly he has absorbed and processed the information about it. Similarly, it would also appear that the infant, in effect, has "taken in" and integrated all the perceptual data about the stimulus he is capable of absorbing. In fact, he may have "learned" something.

This process is clearly a mental one. It is theorized that the more efficient the nervous system, the sooner an infant's interest in a given stimulus will wane. It would also be reasonable to assume that repeated exposure to the same stimulus should produce progressively reduced attentional responses. Finally, it can be hypothesized that as the infant

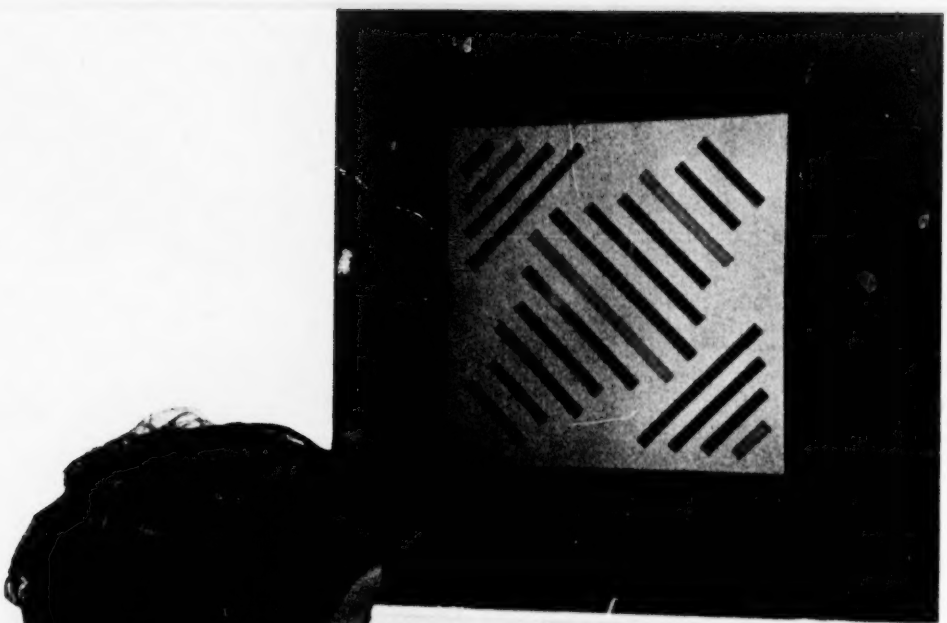
ages, his attention span will alter, growing shorter in response to repeated sensory stimuli. His nervous system is becoming more efficient and active, and data are being processed more rapidly.

## THE OBSERVATION OF ATTENDING

The techniques for observing attentional response have been refined from procedures developed previously by Dr. Lewis and other researchers. Babies selected for the ETS study (about 200 to date) range in age from three to 24 months, in order to determine response norms at various age levels within this group.

The infant is seated comfortably in a specially-designed Infant Enclosure, facing a screen on which visual displays are presented. The mother is seated behind her child, but out of his sight. Recording contacts are attached to the infant to gauge various physiological changes, and trained observers record his responses.

The child is shown a series of pictorial images, including geometrical shapes and human faces. He is also presented with a series of sounds. Following this, the infant is given standard tests of mental and motor development.



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The physiological and behavioral data are then fed into a computer for a precise analysis of the attentional response. In addition, records of the infant's physical condition at birth are introduced into the evaluation. To complete the record, information on the nature and amount of social, intellectual, and emotional stimulation found in the home is gathered.

## SOME CONCLUSIONS

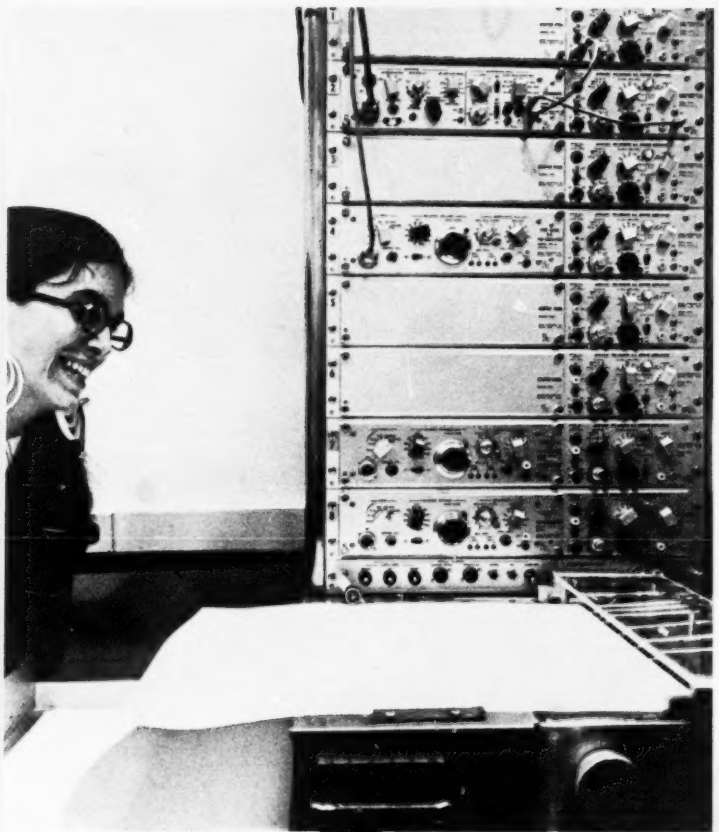
During the course of their investigations, the researchers at the Infant Laboratory have observed certain physical phenomena which confirm a number of assumptions about the development and significance of attentional response. For example, the infant's response to an arresting stimulus can be identified by the following physical reactions:

- his eyes open wider
- his pupils expand
- his breathing slows and becomes more regular
- his heart rate slows
- his motor movements decrease
- he begins babbling if the stimulus has social content (i.e., pictures of people)
- he stops babbling if the stimulus is either abstract or non-human in content

It is interesting to note that the first five of these reactions are nc different from those displayed by an adult who is attentive to a stimulus.

In addition to these purely physical reactions, the project has produced some valuable observations about early human behavior. Some of the findings are as follows:

- An infant of any age who is repeatedly shown a light pattern or image will gradually become "habituated" to it and therefore less attentive.
- Older infants will lose interest more rapidly in the identical series of sensory stimuli which are presented to younger infants. Attention span to redundant stimuli decreases at a consistent rate as infants get older.
- Changes in response to repeated stimuli are similar to those of adults and animals. The implication is that attending (and its consequent meaning) is a common manifestation in many living organisms.



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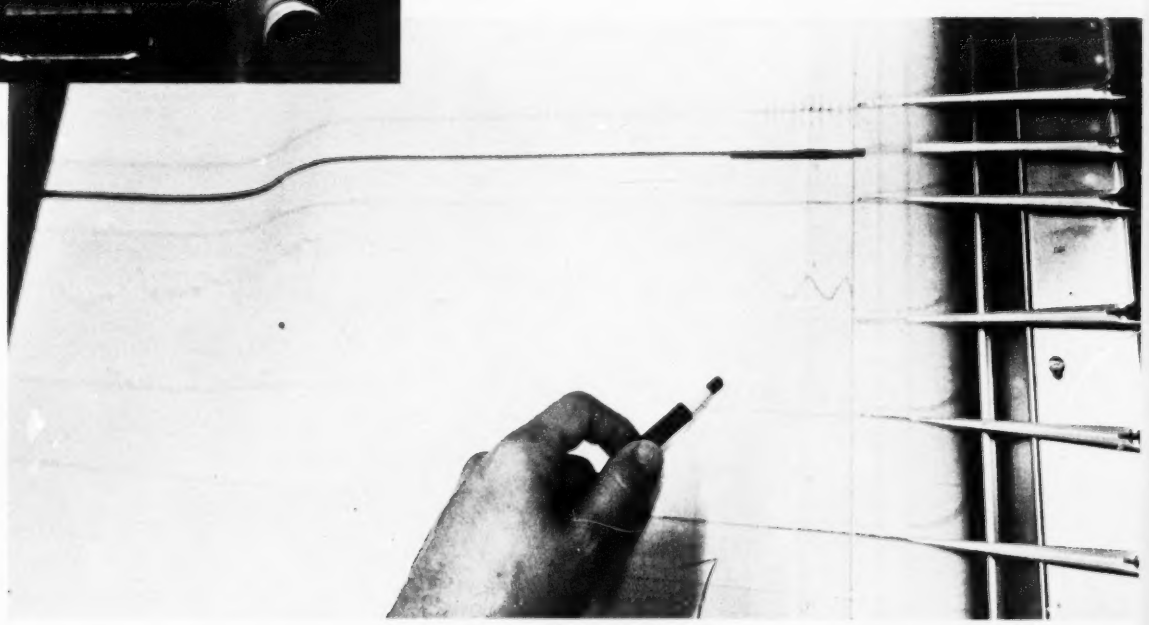

- Babies up to the age of three months do not exhibit very much of this decrease in attention. Only beyond that age is there a measurable waning of interest in sensory stimuli. It would seem that at three months certain cerebral reorganizations begin to take place. Mental processes then evolve which permit the infant to be better able to respond to sensory impulses.
- The infant suffering from brain damage, resulting either from birth accidents or congenital defects, may show little or no diminishing attention to sensory stimuli. Consequently, the methodology employed in the study could be adapted to detect nervous system dysfunction in infancy much earlier than other techniques permit.
- Infants who are provided with more home environmental stimulation (i.e., reading, talking, playing) habituate faster to test stimuli. They appear to be more intellectually alive.

These, then, are some of the major conclusions about attentional response observed during the early months and years of life. Can they in some way be related to an infant's intellectual prospects, and can they provide forecasts of future intelligence?



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## THE PREDICTION OF INTELLIGENCE

Several experimental projects have revealed a relationship between the cognitive development (for example, the formation of concepts) of young children and their shortening attentional responses to an array of visual stimuli. Once again, it appears that, as intellect advances, the child more rapidly absorbs the perceptual content of the presentation.

Groups of youngsters, at one, two, and three years of age, were exposed to the standardized sensory presentations employed by the Infant Laboratory. They were simultaneously given cognitive tasks to determine how well they could evolve problem-solving strategies. Some of the tasks required the children to differentiate between items of different colors, sizes, and shapes. The efficiency with which they were able to successfully complete their tasks was generally consistent with their habituation to sensory events.

It is reasonable, therefore, to suppose that the child who was quickly bored with these fairly simplistic sensory stimuli had absorbed the data about them rapidly through highly active mental processes. He displayed an alert intelligence.

It follows that the infant's rate of boredom (only this is measurable since he is too young to undertake parallel testing of his cognitive learning abilities) is a yardstick of his intellectual potential. While the infant is still too undeveloped to demonstrate intellectual accomplishment, his related attentional response is "visible" and measurable. This suggests that infant behavior can be used to predict subsequent intellectual performance. However, much more experimentation must be undertaken in order to establish precisely how this forecasting can be accomplished.

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The research team at the Infant Laboratory is engaged in further projects aimed at perfecting this predictability, and at exploring the social and cultural factors which also affect infant performance.

The researchers feel that, in order to map infant development properly, intellectual and personality variables must not be separated. Behavioral patterns must be traced in terms of the infant-mother relationship and the cultural environment in which it operates.

For this reason, the Infant Laboratory team has been studying the nature of the infant-parent interaction. In addition, the study will soon be expanded to the population of infants being reared in economically disadvantaged circumstances. From these studies may well emerge not only a revealing view of what socioeconomic factors help or hinder intellectual growth, but also of how interpersonal factors may affect the infant's developmental process. The research at the Infant Laboratory, in dealing with the manifestations of intelligence in these terms, is expanding our knowledge about this prime human resource.

Dr. Michael Lewis is the director of the Infant Laboratory. He is a research psychologist in the Human Development Research Group of ETS's Division of Psychological Studies. Dr. Lewis, a University of Pennsylvania Ph.D., is a specialist in the intellectual and personality development of infants and young children. He was formerly Senior Investigator at the Fels Research Institute and Associate Professor of Developmental Psychology at Antioch College. He is a fellow of the American Psychological Association and a member of the Society for Research in Psychophysiology, the Society for Research in Child Development, the American Association for the Advancement of Science, Psychologists Interested in the Advancement of Psychotherapy, and the New York Academy of Science. Dr. Lewis is currently a consulting editor of *Perceptual-Cognitive Development*.

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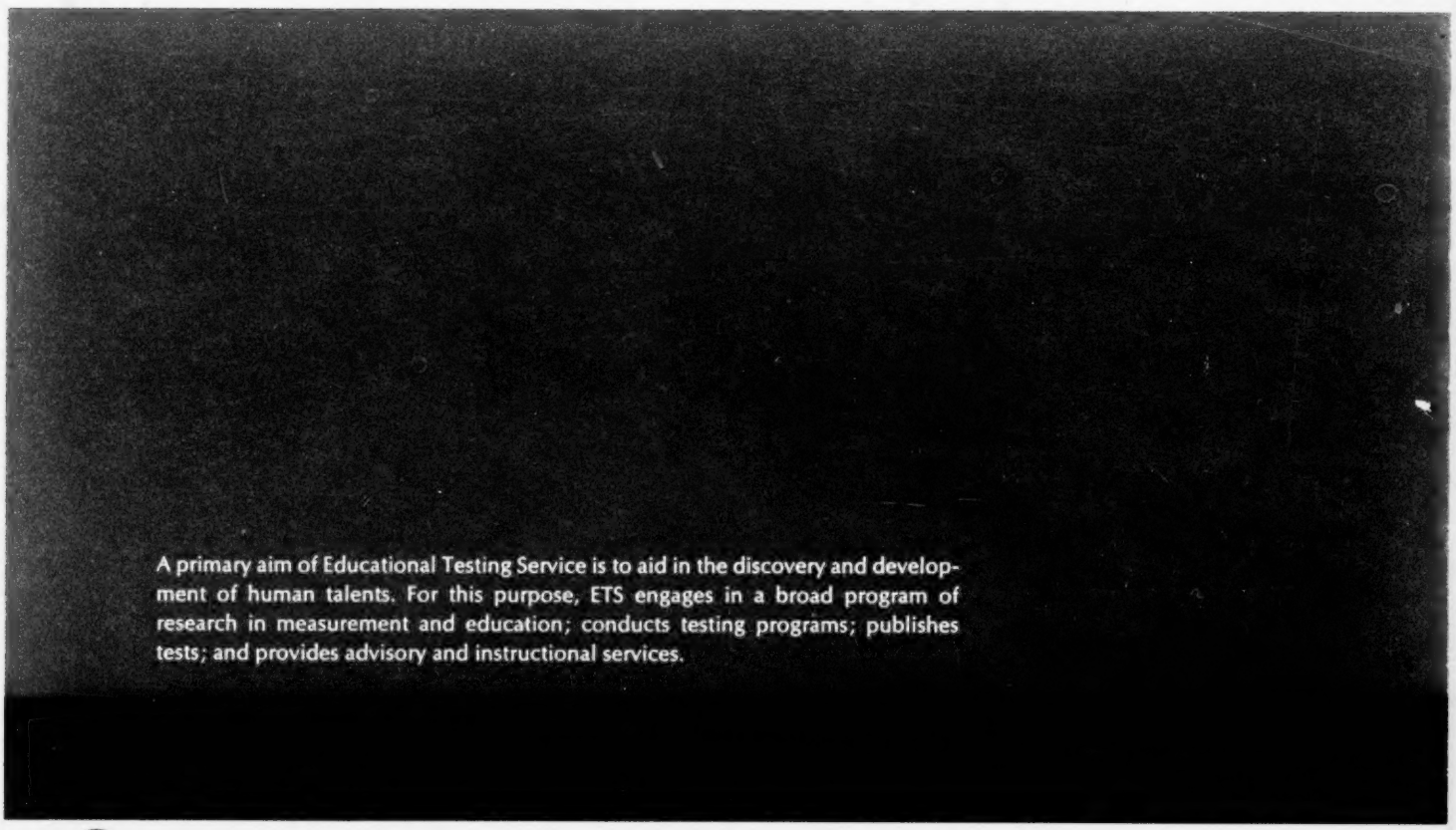
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